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The protective effect of cinnamon and ginger hydro-alcoholic extract on carbon tetrachloride-induced testicular damage in rats

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Abstract

Sexual dysfunction of men is one of the most serious problems in human society. This study aimed to evaluate the protective effect of cinnamon and ginger extract on testicular damages induced by carbon tetrachloride (CCl4). Thirty-six male Wistar rats were randomly divided into 6 groups ($n = 6$): 1. Normal control; 2. Carbon tetrachloride (CCl4); 3. CCl4 + Cinnamon; 4. CCl4 + Ginger; 5. CCl4 + Cinnamon and Ginger; and 6. Cinnamon + Ginger. CCl4 (1 ml/kg) was injected intraperitoneally on the 14th day, and cinnamon (50 mg/kg, orally) and ginger (250 mg/kg, orally) were administered daily for 14 days. Fifty hours after the CCl4 injection, the testicles and epididymis were separated and examined as to histological alterations and oxidative stress markers. CCl4 significantly increased malondialdehyde level and decreased total antioxidant capacity when compared to the normal control group ($p < .05$). In addition, degenerative alterations in the testicular and epididymal tissue were observed in CCl4 group. The pre-treatment with ginger and cinnamon extract significantly improved these parameters when compared to the CCl4 group ($p < .05$). The results of this study indicated that co-treatment of ginger and cinnamon reduces the damages induced by CCl4 in testicular tissue by increasing antioxidant capacity and reducing lipid peroxidation.

KEYWORDS
CCl4, cinnamon, ginger, oxidative stress, testis

1 | INTRODUCTION

There are various abnormalities in the male reproductive system including disorders in sperm parameters and sex hormones like the reduction of testosterone, which are induced by cigarette abusing, anti-depressant drugs and consumption of alcohol (Khan, 2012). CCl4 is one of the industrial chemicals that cause liver (Mahmoodzadeh, Mazani, & Rezagholizadeh, 2017), kidney (Suzuki et al., 2015) and testicular damages (Mazani, Banaei, & Rezagholizadeh, 2020) in experimental animals (Scholten, Trebicka, Liedtke, & Weiskirchen, 2015) and humans (Ebrahimi, Azhkani-Esfahani, Emami, & Riazifar, 2013). The decomposition of CCl4 causes oxidative stress by reactive oxygen species (ROS) (Abdel Moneim, 2014). Free radicals attach to polyunsaturated fatty acid (PUFA) in the sperm membrane and generate peroxy and alkoxy radicals which in turn produce lipid peroxides, decrease sperm number, reduce antioxidant enzyme levels and lead to necrosis or damage. ROS induces necrosis and apoptosis of spermatocytes/spermatids and reduces the diameter of seminiferous tubules (Sonmez et al., 2014).

CCl4 is a well-known chemical compound for providing tissue toxicity by the generation of free radicals in many tissues such as the brain (Ritesh, Suganya, Dileepkumar, Rajashekar,

